Site Planners

Properly situated homes pay big dividends

The National Association of Home Builders (NAHB) estimates that 1.6 million new homes will be built each year over the next decade (NAHB 2002a). How these new developments are designed will have a major impact on energy use, the environment, and customer satisfaction.

Developers and site planners can set the stage for efficient communities and can direct builders to protect a community's value through quality building practices.

The sun is the main source of heat in all homes. By looking at how houses receive sunlight, site planners can help optimize how much solar energy is available to heat a house, and minimize the heat that must be removed with air conditioning.

The hot-dry and mixed-dry climates are dominated by cooling rather than heating. Avoiding summer cooling is more important than encouraging solar gains for winter heating. Planners should do all they can to avoid the entry of solar energy into houses in summer. Site planners have two important tools to help avoid solar heat gain: **lot orientation** and, in some areas, **shade trees**.

Lot Orientation

As planners map out lots and roads, the relationship between buildings and the sun should be key. Just as you lay out roads to allow houses to take advantage of great views, or to work around hillsides and other landscape features, also consider how road design, lot lines, and orientation will influence the way that houses face the sun.

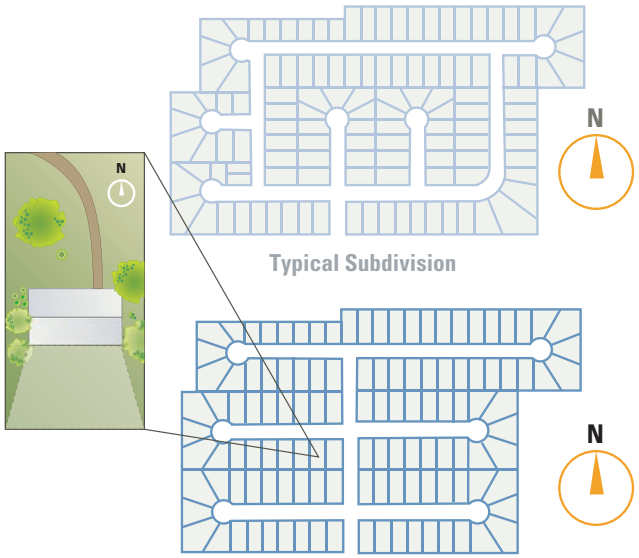
Lot lines and roads should be situated to minimize home exposure to east and west. These orientations provide the greatest solar heat gains. Plan your subdivision so that the longer sides of the houses will face north or south. Streets should be positioned in an east-west direction. Proper orientation can result in substantial savings of heating and cooling costs, depending on specific site conditions and house designs. Highly efficient houses, especially when good windows are used, are less dependent on orientation and shading to manage solar gain. With proper planning, there may be no added costs to the builder for good orientation.

QUICK TIPS | SITE PLANNERS

- Lots facing north or south are preferred to manage heat gain from the sun, so position streets to run east and west.
- Preserve trees for shade and cooler air.
- Take advantage of prevailing breezes from lakes, the ocean, or other geographical features.
- Properly grade your development to take water away from structures.
- Use sustainable site and landscaping practices.

Shading is not nearly as important when windows with a low solar heat gain coefficient (i.e., SHGC of 0.35 or less) are used. Using a low-solar-gain low-E coating results in great energy cost reductions for all conditions even with no shading. This is because the glazing itself provides the necessary control of solar radiation, so these additional measures become less important in terms of energy use. For a description of the interactions between window performance and shading, see the Efficient Windows Collaborative Web site at: www.efficientwindows.org.

FIGURE 1: Plan subdivision lot lines and roads for predominantly north and south orientation - place houses within lots to take advantage of solar access



Subdivision with Predominantly North- and South-Facing Sites

Adapted from Viera et al. 1992. p.3-5

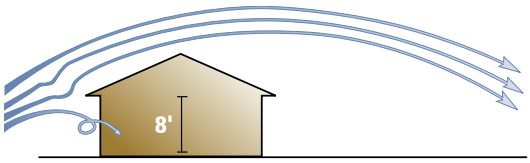
Lot orientation is especially important if solar heating or electric generation systems are planned. Inexpensive tools can help assess how much solar energy will be blocked by obstacles on a particular site. Low-cost tools for solar assessments are described in the *Designers* chapter in the section about windows.

Lot orientation provides access to the sun, but window selection and shading are the controls that manage solar gain. A small Solar Heat Gain Coefficient (SHGC) limits the entry of solar energy. Some Building America teams recommend a SHGC of 0.35. (See the *Designers* chapter in the section about windows).

In addition to helping manage the sun and providing a marketing advantage, proper street design can reduce the environmental impacts of runoff, encourage walking and bicycling, and discourage speeding by through-traffic.

Subdivision planning can also help to gain cooling benefits from breezes. Houses and other buildings that are tightly packed may create a wake in the wind that is four to five times the buildings' eave height.

FIGURE 2: Wind wake of a typical house



Wind Wake of a Typical House

Source: Viera et al. 1992. p.3-7

Curved streets and staggered lots can assist in preventing wind disturbance. Trees can help to keep breezes cool as described in the next section. Taking advantage of breezes will reduce cooling costs. Wind conditions at any individual site may differ considerably from regional averages. Local geography such as ocean beaches, lakes, fields, golf courses, parks, and malls can influence local breezes.

Shade Trees

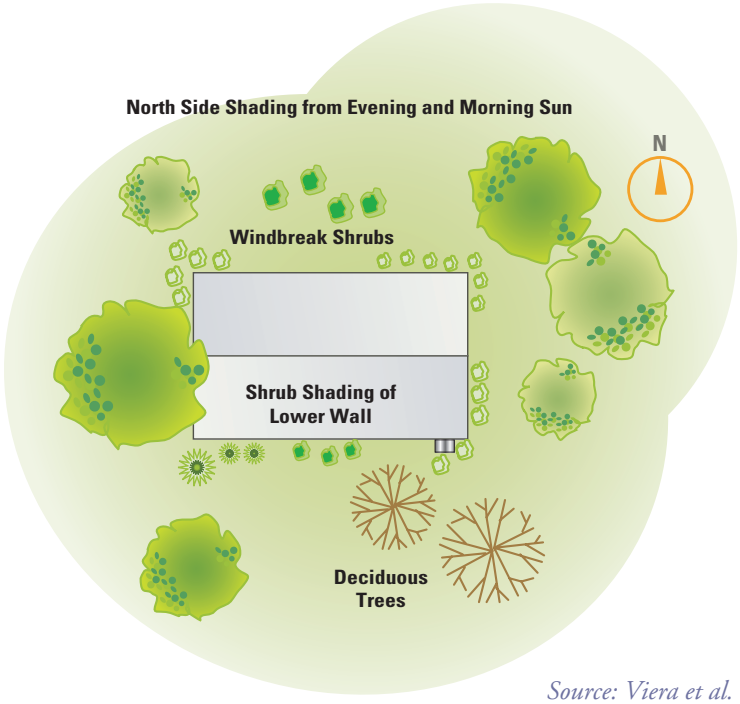
Tree preservation brings many benefits, one of which is increased salability. Native trees are most beneficial to the environment. The NAHB reports in its survey of buyers, *What 21st Century Homes Buyers Want*, that over 80% of respondents in the West rated trees as essential or desirable (2002b, page 61). In 1992, the Florida Solar Energy Center (FSEC) estimated that a treed lot in Florida may increase the value of a home by as much as 20%. American Forests and the NAHB (1995) found that mature trees may add from $3,000 to $15,000 to the value of a residential lot.

Trees also bring value by providing shade. It is far better to prevent solar energy from reaching a house than to attempt to manage it once it enters. Shade trees block summer sunlight before it strikes windows, walls, and roofs, dissipating absorbed heat to the air where it can be carried away by the breeze. If photovoltaic or water heating systems will be added, trees must be placed not to shade these systems.

Truly cool neighborhoods have trees. A study in Florida has shown that a subdivision with mature trees had cooler outside air with less wind velocity than a nearby development without trees (Sonne and Viera. 2000). The development with a tree canopy had peak afternoon temperatures during July that were 1.1°F to 3.1°F (± 0.7°F) cooler than the site without trees. The total effect of shading, lower summer air temperature, and reduced wind speed can reduce cooling costs by 5% to 10% (McPherson et al. 1994).

Trees are most effective when located to cast shade on the roof, windows, walls, and air conditioners, and when located on the side of the home receiving the most solar exposure. Shade to the southwest and west is especially important for blocking peak solar gain in the summer in late afternoon. Depending on the species, trees more than 35 feet from the structure are probably too far away for shade. Plants too close to air conditioners or heat pumps can plug coils.

FIGURE 3: Configuration of shade trees



Source: Viera et al. 1992. p.3-8

Xeriscaping

However, trees will not work everywhere. In the low-water environments that dominate much of the Southwest, lots should be landscaped to take advantage of plants that use less water than traditional turf-dominated approaches. Many communities have been faced with increased demands on existing water supplies. Consequently, there is a greater focus on water conservation, not just in times of drought, but in anticipation of future population growth. Water can no longer be considered a limitless resource. Conserving water through creative landscaping has engendered the new term, xeriscape. The term is taken from the Greek *xeros*, meaning dry, in combination with landscape.

Example of xeriscaping showing that low-water, low-maintenance plantings can be a practical and attractive option. (Photo by Warren Gretz)

The goal of a xeriscape is to create a visually attractive landscape that uses plants selected for their water efficiency. Properly maintained, a xeriscape can easily use less than one-half the water of a traditional landscape. Once established, a xeriscape should require less maintenance than turf landscape.

By grouping plants with similar water needs together in specific zones, a xeriscape landscape can use water more efficiently. Low-water-use plants should be grouped together, away from high-water-use plants and turf. Take advantage of warm or cool microclimates (the actual climatic conditions around your property which can be influenced by the placement of walls and shade trees) to create areas of interest and diversity.

A well-planned and well-maintained irrigation system can significantly reduce a traditional landscape's water use. For the most efficient use of water, irrigate turf areas separately from other plantings. Other irrigation zones should be designed so low-water-use plants receive only the water they require. Proper irrigation choices can also save water. Turf lawns are best watered by sprinklers. Trees, shrubs, flowers, and groundcovers can be watered efficiently with low-volume drip emitters, sprayers, and bubblers.

The information presented here was adapted from the City of Albuquerque's Web site at www.cabq.gov/waterconservation/xeric.html. Many jurisdictions in dry landscapes have information, including potential rebates and other incentives.

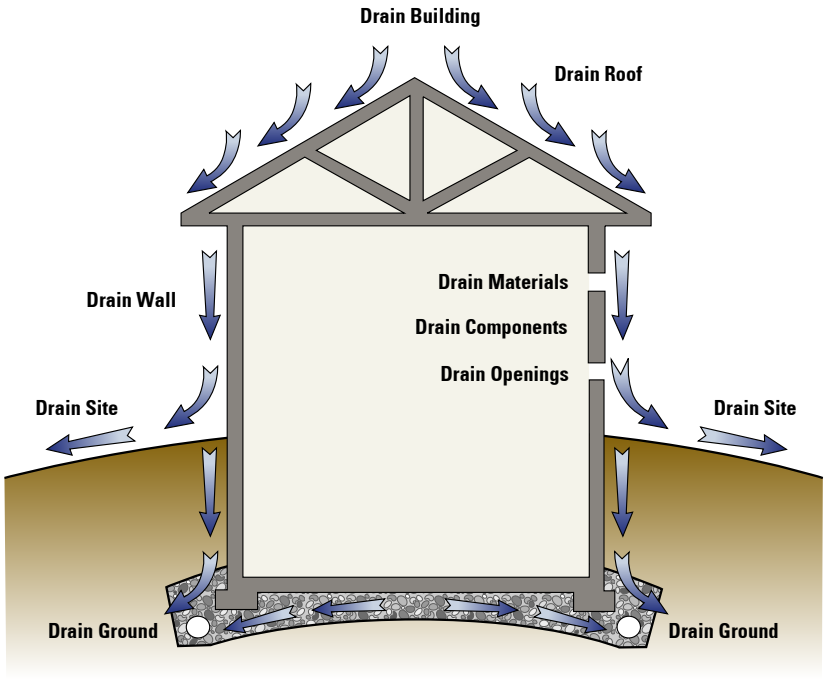
Other Steps

In addition to orientation and the use of trees, many other steps can be taken during site planning to make developments user and earth friendly.

Site Grading

Proper site grading directs surface water away from building foundations and walls. The steeper the slope away from the building, the better the water will drain. Slabs and crawlspaces should always be above the surrounding grade. Basement floors should be higher than the surrounding drainage system. Driveways, garage slabs, patios, stoops, and walkways should all drain away from the structure. See EEBA's *Water Management Guide* (Lstiburek 2003) for more information. Additional information on moisture management is also available in the *Designers* chapter.

FIGURE 4: Drain all water away from the structure



Source: Lstiburek, J.W. 2003. p.4

Sustainable Development

Builders who choose to advertise their "green" designs have found that buyers are willing to pay for environmental features.

Features that help to conserve the natural environment can include:

- Orienting lots to best manage energy and light from the sun.
- Land planning that preserves the natural environment and minimizes land disturbance.
- Site design that minimizes erosion, paved surfaces, and runoff.
- Preserving and protecting trees and natural vegetation.
- Conserving water indoors and out.
- Designing energy efficiency into houses.
- Selecting materials that are durable and recyclable, or created from recycled products, and considering the energy that goes into making products.
- Recycling construction materials and reducing on-site waste.

Good places to start on sustainable development are found in the *New Home Construction Green Building Guidelines* by Alameda County, CA (Alemeda County 2003), Rocky Mountain Institute's *Green Development: Integrating Ecology and Real Estate* (Wilson, et. al. 1998), the NAHB's *Building Greener: Building Better: The Quiet Revolution* (NAHB 2002c), the Sustainable Building Council's *Green Building Guidelines* (SBIC 2003), www.lid-stormwater.net, a U.S. EPA-sponsored Web site with tools for watershed management, and DOE's Smart Communities Network at www.sustainable.doe.gov.

"What we tell buyers is that we sell value…it's about high standards in every aspect of home building…The whole idea is to get builders all over the country more concerned about building this way—it's about energy efficiency, indoor air quality, waste recycling, water recycling, better planning—it all leads to better development."

GW Robinson,
President of GW Robinson

G.W. Robinson pipes recycled irrigation water to cut water use and costs to homeowners at the Cobblefield development in Gainesville, Florida.

Sources and Additional Information

- Alameda County Waste Management Authority & Source Reduction and Recycling Board. 2003. *New Home Construction Green Building Guidelines*. San Leandro, CA. www.stopwaste.org
- American Forests and the National Association of Homebuilders. 1995. *Building Greener Neighborhoods: Trees as Part of the Plan*. NAHB, Washington, D.C.
- Lstiburek, J.W. 2003. *Water Management Guide*. Energy and Environmental Building Association, Minneapolis, Minnesota. www.eeba.org
- McPherson, G.E., D.J. Nowak, and R.A. Rowntree (eds). 1994. *Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project*. U.S. Department of Agriculture, Forest Service, Northeastern Research Station, www.f.fed.us/ne/newtown_square/publications/technical_reports/pdfs/scanned/gtr186a.pdf
- National Association of Homebuilders. 2002.a *Builder's Guide to the APA's Growing Smart Legislative Guidebook.* NAHB, Washington, D.C.
- National Association of Home Builders. 2002b. *What 21st Century Home Buyers Want: A Survey of Customer Preferences*. NAHB, Washington, D.C. www.BuilderBooks.com
- National Association of Homebuilders. 2002c. *Building Greener: Building Better: The Quiet Revolution*. NAHB, Washington, D.C.
- Sustainable Buildings Industry Council (SBIC). 2003. *Green Building Guidelines: Meeting the Demand for Low-Energy, Resource-Efficient Homes*. U.S. DOE. Washington, D.C. document available at www.SBICouncil.org.
- Sonne, J.K. and R.K. Viera, 2000. "Cool Neighborhoods: The Measurement of Small Scale Heat Islands." *Proceedings of the 2000 Summer Study on Energy Efficiency in Buildings*, American Council for an Energy-Efficient Economy, Washington, DC. www.fsec.ucf.edu/bldg/pubs/pf363/index.htm
- Viera, R.K., K.G. Sheinkopf, and J.K. Sonne. 1992. *Energy-Efficient Florida Home Building*, third printing. Florida Solar Energy Center, FSEC-GP-33-88, Cocoa Beach, Florida.
- Wilson, Alex, Jenifer L. Seal, Lisa A. McManigal, L. Hunter Lovins, Maureen Cureton, William D. Browning. 1998. *Green Development: Integrating Ecology and Real Estate*. Rocky Mountain Institute, Old Snow Mass, CO. www.rmi.org/sitepages/pid220.php

Web Sites Not Included with Published Documents Above

- www.cabq.gov/waterconservation/xeric.html
- www.lid-stormwater.net
- www.sustainable.doe.gov